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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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Vol. 48 No. 2

BULLETIN

OF THE

TORREY BOTANICAL CLUB

FEBRUARY, 1921

Contributions to the Mesozoic flora of the Atlantic coastal plain, XIV.—Tennessee*

EDWARD W. BERRY

In the eleventh contribution of this series, published in 1916,† an account was given of small floras found in the Coffee sand and McNairy sand of the west Tennessee coastal plain. Fourteen species were recorded from the former and twelve from the latter, both florules confessedly too limited to give any idea of their general facies or stratigraphic equivalence. During the summer of 1919 Dr. Bruce Wade of the Tennessee Geological Survey discovered abundant and better preserved material at several localities in the Eutaw and Ripley formations. These collections have now been identified and furnish for the first time the basis for a truer estimate of this youngest known Cretaceous flora of the Mississippi embayment region and an opportunity for comparisons with the fossil floras of other areas.

The time relations of the various members of the Upper Cretaceous section in this area are shown in the accompanying diagram. The Tuscaloosa formation which has furnished an extensive flora recently monographed by the writer‡ comprises essentially continental and largely delta deposits contemporaneous with the basal estuary and marine beds of the Eutaw formation.

[The BULLETIN for January (48: 1–54) was issued January 24, 1921.]

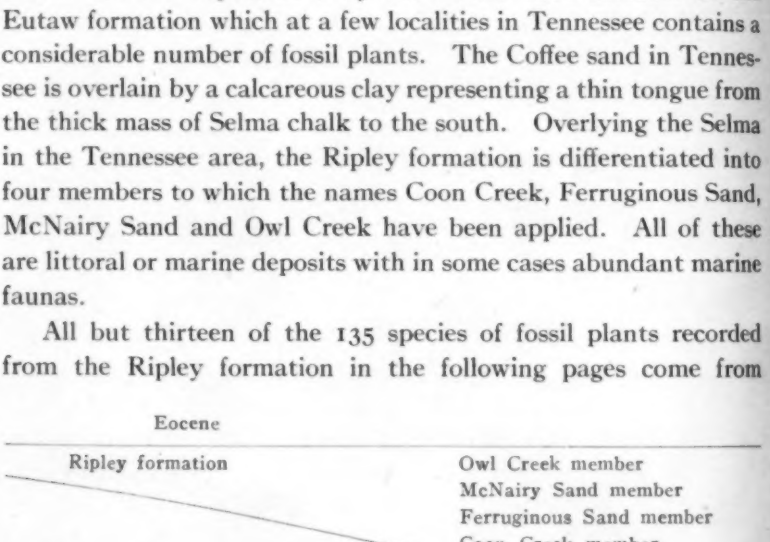
* The last previous contribution of this series appeared in Bull. Torrey Club 47: 397–406. 1920.

† Bull. Torrey Club 43: 283–304. *pl. 16.* 1916.

‡ U. S. Geol. Surv., Professional Paper 112. 1919.

The Tombigbee sand member of the Eutaw formation represents transgressive marine deposits without land plants but with a marine fauna. To the southward the Tombigbee is overlain by the Selma chalk—a lithologic and not a chronologic unit. In western Tennessee the time interval corresponding to the lower Selma chalk is represented by the Coffee sand member of the Eutaw formation which at a few localities in Tennessee contains a considerable number of fossil plants. The Coffee sand in Tennessee is overlain by a calcareous clay representing a thin tongue from the thick mass of Selma chalk to the south. Overlying the Selma in the Tennessee area, the Ripley formation is differentiated into four members to which the names Coon Creek, Ferruginous Sand, McNairy Sand and Owl Creek have been applied. All of these are littoral or marine deposits with in some cases abundant marine faunas.

All but thirteen of the 135 species of fossil plants recorded from the Ripley formation in the following pages come from



shallow water lenses of plastic clay in the McNairy sand member. These clay lenses represent accumulations of fine material in estuary or coastal lagoon waters with a well forested shore near at hand. The accompanying diagram shows the stratigraphic units and their general relations in the Mississippi embayment region.

FLORA OF THE EUTAW FORMATION

The Eutaw flora is still incompletely known. The Eutaw sediments, in so far as they might preserve land plants successfully, are either marine clays or littoral, prevailingly sandy, deposits. The former contain only decay-resisting forms, such as *Araucaria* twigs and coriaceous dicotyledons, and the latter similar forms that successfully withstood the triturating action of troubled waters, since as yet no clay lenses with any extensive representation of plants that grew along the Eutaw shores have been discovered. The Eutaw flora, which has been collected chiefly from the Chattahoochee valley in Georgia, from near Havana in Hale County, Alabama, and from near Beacon in Decatur County and at Coffee Bluff in Tennessee, consists of but forty-six species. It includes no ferns, thirty-four angiosperms and eleven gymnosperms. Among the latter are the genera *Androvettia*, *Brachyphyllum*, *Cephalotaxospermum*, *Cupressinoxylon*, *Sequoia* and *Tumion*, which are unknown in the Ripley, as well as the twigs and scales of *Araucaria* which, although recorded from the Ripley, come from deposits of the same age as the Eutaw in other regions. These are preserved in the Eutaw because of their resistance to maceration but should be present in the Ripley if they had not become extinct.

Similarly among the dicotyledons the prevailing forms found in the Eutaw are coriaceous types, such as *Andromeda*, *Cinnamomum*, *Ficus*, *Magnolia*, *Myrcia*, *Manihotites*, *Sabalites* and the like. Following is a list of the known Eutaw species, those marked with an asterisk being also present in the Ripley. Sixteen of the Eutaw species continue into the Ripley, but the following genera of the Eutaw have not been recognized in the Ripley: *Androvettia*, *Brachyphyllum*, *Cephalotaxospermum*, *Cupressinoxylon*, *Dewalquea*, *Diospyros*, *Paliurus*, *Pterospermites*, *Sequoia* and *Tumion*.

Andromeda cretacea Lesquereux? (Ga.)
Andromeda novae-caesareae Hollick
Andromeda Parlatorii Heer (Ala.)
Andromeda Wardiana Lesquereux (Ga., Tenn.)
Androvettia elegans Berry (Ga.)
Aralia eutawensis Berry (Ga.)
Araucaria bladensis Berry (Ga.)*

Araucaria Jeffreyi Berry (Ga.)*
Bauhinia alabamensis Berry (Ala.)
Brachyphyllum macrocarpum formosum Berry (Ga.)
Cephalotaxospermum carolinianum Berry (Ala.)
Cinnamomum Heerii Lesquereux? (Ga., Tenn.)
Cinnamomum Newberryi Berry (Ga.)*
Cupressinoxylon sp. Berry (Tenn.)
Dewalquea Smithii Berry (Tenn.)
Diospyros primaeva Heer (Tenn.)
Doryanthites cretacea Berry (Ala.)
Ficus crassipes (Heer) Heer (Ga., Tenn.)*
Ficus Krausiana Heer (Ga., Tenn.)*
Ficus ovatifolia Berry (Ga., Tenn.)
Geonomites Schimperi Lesquereux (Tenn.)*
Halymenites major Lesquereux (Tenn.)*
Juglans arctica Heer (Ga.)
Laurophyllum elegans Hollick (Tenn.)
Laurus plutonia Heer (Ala.)
Magnolia Boulayana Lesquereux (Ala., Ga.)
Magnolia Capellinii Heer (Ga.)*
Malapoenna horrellensis Berry (Ga., Tenn.)*
Manihotites georgiana Berry (Ga., Tenn.)*
Menispermites variabilis Berry (Ga.)*
Myrcia havanensis Berry (Ala., Tenn.)*
Myrtophyllum angusta Velenovsky (Ga.)*
Paliurus upatoiensis Berry (Ga.)
Phragmites Prattii Berry (Ga., Tenn.)
Phyllites asplenioides Berry
Pterospermites carolinensis Berry (Tenn.)
Sabalites carolinensis Berry (Tenn.)
Salix eutawensis Berry (Ga., Tenn.)
Salix flexuosa Newberry (Ga.)
Salix Lesquereuxii Berry (Ga.)
Sequoia ambigua Heer (Ala.)
Sequoia Reichenbachi (Geinitz) Heer (Ala., Ga.)
Ternstroemites sp. nov. (Tenn.)*
Tumion carolinianum Berry? (Ga.)
Zizyphus laurifolius Berry (Ga.)*

Plants which come up into the Ripley from pre-Eutaw horizons and therefore legitimately to be considered as probable unknown members of the Eutaw flora are:

Widdringtonites Reichii (Ettings.) Heer
Moriconia cyclotoxon Debey & Ettings.
Moriconia americana Berry
Myrica Brittoniana Berry
Leguminosites canavalioides Berry

FLORA OF THE RIPLEY FORMATION

Determinable fossil plants have been found at thirteen different localities that are referred to the Ripley formation. The localities in Alabama and Georgia which were described recently* furnish but few and on the whole not well-preserved fossil plants. They are separated by some 350 miles of coast line of the Ripley Sea from the southernmost locality for Ripley plants in Tennessee and this in turn is about 100 miles south of the highly fossiliferous localities in Henry and Carroll Counties. The other Tennessee localities are much like those of Alabama and Georgia as regards the character of the remains and their condition of preservation. It is at the Perry Place in Henry County and the Cooper Pit in Carroll County that most of the information regarding the Ripley flora has been collected.

Curiously enough each of these localities has yielded a total of sixty-six different species, and still more interesting is the fact that of this relatively large number there are only fifteen species common to both localities, or slightly under 13 per cent. of the total number of 117 species represented at the two localities. This differences of facies is not only a difference in species but in genera. For example at the Perry Place locality there are present the genera *Dioscorites*, *Geonomites*, *Protophyllocladus*, *Juglans*, *Salix*, *Liriodendron*, *Menispermites*, *Capparis*, *Acaciaphyllum*, *Caesalpinites*, *Dalbergia*, *Pachystima* (?), *Rhamnus*, *Cissites* and *Bumelia*, that are not found at the Cooper Pit, and the latter locality has furnished representatives of the genera *Selaginella*, *Asplenium*, *Monheimia*, *Widdringtonites*, *Geinitzia*, *Potamogeton*, *Alismaphyllum*, *Dryophyllum*, *Fagus*, *Celtis*, *Cedrela*, *Acer*,

* U. S. Geol. Surv. Professional Paper 112. 1919.

Dillenites, *Cinnamomum*, *Nectandra*, *Myrcia*, *Eugenia* (?), *Cornophyllum*, *Chrysophyllum* and *Acerates*, which have not been found at the Perry Place. Farther than this among the larger genera, *Myrica* with eleven species has only one common to the two localities, only two of the Leguminosae are common to both localities, of the seven species of *Celastrophyllum* there is but one species found at both outcrops, of the nine figs none are common to both, of the five species of *Apocynophyllum* none are common, of the three species of *Zizyphus* only one is common and that one is rare at one locality and abundant at the other; similarly of the three species of *Ternstroemites* only one is found at both localities.

Since these two horizons have been shown by the mapping to practically coincide these marked differences in apparent facies can be due to but two causes. That is they are to be accounted for solely as the result of accidents of preservation or discovery or as due to local differences in environmental conditions at the time of growth. Possibly a combination of these two is the correct solution. I am inclined, however, to think that in this as in many other cases of fossil floras and faunas, accidents of preservation and discovery are the major factors, and this emphasizes anew the extreme danger of relying upon negative evidence, since did we not know otherwise we should doubt the contemporaneity of these two florules.

All of the remaining localities where Ripley plants have been discovered have yielded too few species to afford satisfactory evidence for close correlation. Those in Tennessee are known to be of approximately identical age as the Perry Place and Cooper Pit from their stratigraphic position. Those in Barbour County, Alabama are undoubtedly Ripley but whether younger or older than the Tennessee floras cannot be determined. The two plant-bearing localities in Georgia wh'ch L. W. Stephenson has referred to the Cusseta sand member or lower Ripley of the Georgia area are of especial interest since they are the same age as the Coffee sand of Tennessee.

The localities of Henry and Carroll Counties, Tennessee, are well toward the head of the Cretaceous Mississippi embayment and over three degrees north of the localities in Barbour County, Alabama or of the Ripley localities in Georgia. Moreover it is

becoming increasingly clear that a large body of Upper Cretaceous deposits across Tennessee and Kentucky has disappeared during the formation of the Tennessee valley, so that in Selma and Ripley time the shoreline was some distance to the east of the present outcrop of these deposits and there was a considerable re-entrant or bay extending eastward from the head of the late Cretaceous Mississippi Gulf.

These relatively slight geographical changes are not believed to show any reflection in the facies of the flora, nor is it believed that their position with relation to the Atlantic or their difference in latitude would have an appreciable effect, since the corresponding floras extend over many degrees of latitude without appreciable changes as is also true of the contemporaneous marine faunas. The few Ripley plants previously recorded were coriaceous decay-resisting forms that might have been transported for considerable distances, but those from Henry and Carroll Counties present every indication of having lived in the vicinity where they were preserved. Their state of preservation indicates this as well as the abundance of small delicate and long slender forms. There could have been no wave action where these fine-grained clay lenses were deposited so that the clay owes its origin to the settling from suspension of muds either in a sheltered lagoon along the coast or in a quiet estuary or bayou of a slow moving stream. The clay is not black and carbonaceous in so far as it is exposed, but the thickness seen is inconsiderable and immediately below the upper contact with the sands so that nothing is known of the character of the lower clay.

The sands are coarse beach and barrier beach sands and the clay lenses tend to have their long axis approximately parallel to the old coast line. In general character the relations are very similar to those which obtain during the lower Eocene in this same region. This argillaceous horizon is a rather persistent one, consisting of disconnected lenses of greater or less extent which extend in a north and south direction for a distance of at least 50 miles across Henry and Carroll Counties. Farther north in Henry County there is a considerable bed of lignite upwards of 20 inches thick exposed, but none is seen near the plant-bearing outcrops nor is the base of the clay exposed.

The conditions may be pictured as a series of coastal lagoons stretching along the shore of the Ripley Sea from which they were partially or wholly cut off by barrier beaches. Those less sheltered were filled with the argillaceous sands such as occur west of Camden, Tennessee, and farther south, where most of the plant fragments were broken up, and the more or less carbonaceous clays contain identifiable fragments of only the more resistant types. The lagoons represented by the Perry and Cooper localities were more sheltered and protected from wave action, at least for long intervals, during which the fine muds were deposited. That there were no considerable streams emptying into the Ripley Sea in the Tennessee region is rendered very probable by the history of the Tennessee River lying to the eastward. The Tennessee appears to have been the master stream at that time, following much the same course that it does at the present time but farther to the eastward, its distributaries having migrated northward during Tuscaloosa time, as I have indicated in the discussion of Tuscaloosa history in 1919 (*op. cit.*). The Ripley mainland appears to have been well wooded. There is no evidence of distinctively palustrine conditions at the two principal plant localities, although elsewhere at this time such evidence is present. There are, however, several supposed aquatic plants present in the collection, and the number of coastal types is considerable.

The Ripley flora as at present known comprises 135 species, including the doubtfully organic remains named *Halymenites*. Most of these species are represented by well preserved and ample material and are hence well characterized. Undoubtedly more extensive collecting would greatly increase the number of species and this is also to be expected should similar highly fossiliferous clay lenses be uncovered in the future. Eighty-six of the 135 species, or more than 60 per cent, are new to science and these include the following genera hitherto unknown in deposits older than the Eocene: *Dioscorites*, *Celtis*, *Capparis*, *Cedrela*, *Dillenites* and *Chrysophyllum*.

The total number of genera is seventy-one and these are segregated into forty families representing twenty-eight orders. The supposed alga, *Halymenites*, and the form referred to the genus *Selaginella* are of doubtful botanic affinity. There are

represented very fragmentary remains of six different species of ferns. These are all small and of more or less doubtful botanical identity but of importance for purposes of correlation since nearly all are found in other areas, especially in Greenland and Europe. There are nine species of gymnosperms, but several of these are of somewhat doubtful age value and traces of plants of this affinity are extremely rare in western Tennessee.

The monocotyledons also number nine species, including a fan palm, and a feather palm which is referred to the genus *Geonomites* and is a type that is prominent in the lower Eocene of the Raton Mesa region. Several of the monocots appear to represent aquatic or semi-aquatic species. Thus there is a well marked *Potamogeton* and the mudflat type *Alismaphyllum*. In addition the forms named *Phyllites hydrilloides* and *Phyllites hydrocharitoides* appear to represent aquatics. The former shows great resemblance to *Hydrilla* of the family Hydrocharitaceae, a genus supposed to be monotypic in the existing flora and widely distributed throughout the Old World. The second appears to represent an Upper Cretaceous type of this same family comparable in its habit with the existing genus *Vallisneria*.

The dicotyledons of the Ripley flora number one hundred eight of which ninety-seven belong to the more primitive or choripetalous series and only eleven represent the more specialized Gamopetalae. Among the Choripetalae the anemophilous forms, regarded as primitive by some botanists and reduced by others, number nineteen. The largest alliance is the Rosales with fourteen species, all of which belong to the Leguminosae. Since these represent the three families Mimosaceae, Caesalpiniaceae and Papilionaceae no one is more extensive than another or compares in size with some of the other families present at this time.

The second largest family is the Lauraceae with twelve species, but my recognition of minute differences in the genera *Cinnamomum* and *Laurus* tends to overemphasize their relative importance in the Ripley flora. The family Myricaceae is third in size with eleven species, all of which belong to the genus *Myrica*, which shows an extraordinary differentiation at this time. The next most abundantly represented family is the Moraceae with ten species, nine of which are referred to *Ficus* and the tenth to a

striking new form of *Artocarpus*. None of the species of *Ficus* are individually abundant in the collections. Then follows the family Celastraceae with seven species. The family Apocynaceae has five species all of which are referred to the genus *Apocynophyllum*. The Euphorbiaceae, Rhamnaceae and Myrtaceae have four species each; and the Juglandaceae, Fagaceae, Ternstroemaceae and Sapotaceae have three species each. The remaining families have only one or two species. The largest single genera are *Myrica* with eleven, *Ficus* with nine, and *Celastrophyllum* with six species. If the type represented by *Celastrophyllum* were combined with the forms which I refer to *Ternstroemites* but which were formerly referred to *Celastrophyllum* it would constitute the most abundant type in both differentiation and individual abundance.

Among the one hundred five species of dicotyledons of the Ripley flora sixty-eight have entire margins. This is 64.7 per cent of the known forms. The ratio of entire dicotyledons leaves to the whole flora of woody dicotyledons has been shown by Bailey and Sinnott* to have a fairly constant relation to climatic conditions and altitude. According to the figures compiled by these authors subtropical and tropical lowland floras have over 70 per cent of their woody dicotyledons with entire leaves. Their published percentages range from 71 per cent in the flora of Hong Kong to 86 per cent in the flora of the Malay States. In making comparisons with fossil floras one is always confronted with the incompleteness of the record although, on the other hand, the vast majority of fossil forms are arborescent, thus removing one disturbing factor. The Ripley flora is obviously a lowland coastal flora so that the question of altitude is eliminated. It would thus appear that the percentage of entire leaves accords well with the conclusions derived from the general facies of the flora and that the climate was probably warm temperate, rather uniform and with an abundant precipitation.

It is interesting to see in this Ripley flora a characteristic local facies and this is especially the case, as might have been expected, among the dicotyledons. Nearly all of the ferns and all of the conifers have an outside distribution as befits their more

* Bailey, I. W., & Sinnott, E. W. Science II. 41: 832–833. 1915.

ancient lineage and earlier radiation, and only thirty-three, or about 28 per cent, of the angiosperms have been found in other areas. This is still more striking than appears from the bare statement, for if Greenland be excluded as near the probable place of origin of the Upper Cretaceous floras, or at least the ancient home of those of eastern North America, it is seen that only six of the angiosperms are common to distant regions such as Europe. These six are *Dryophyllum gracile*, *Ficus Krausiana*, *Magnolia Capellini*, *Euphorbiophyllum antiquum*, *Cissites crispus* and *Myrtophyllum angustum*.

The Ripley flora shows a marked relationship to that of the antecedent Eutaw formation of this same region, to the Black Creek flora of the Carolinas and to the Magothy flora of New Jersey and Maryland. This is all the more remarkable in the case of the first two when it is realized how small and fragmentary are the known floras of the Eutaw and Black Creek. Thus sixteen of the Ripley species are common to the Eutaw, nineteen to the Black Creek and fifteen to the Magothy. The older Tuscaloosa flora of the eastern Gulf area has but six species which continue on into the Ripley and these are all widely distributed types all being common to either Greenland or Europe. It would appear that the Ripley flora consists of some few forms resident in this region since Tuscaloosa times, with many new elements which were added by immigration or evolution in the interval between the Tuscaloosa and Ripley.

In so far as the present records permit a conclusion the Ripley flora may be regarded as the culmination of the earlier Cretaceous floras of eastern North America. Certain of its species are only Ripley species because of the somewhat inconsistent usage of the formational name Ripley by geologists. Thus *Araucaria bladenensis* and *Araucaria Jeffreyi* which are so highly characteristic of the Black Creek and Eutaw formations are recorded from the Ripley formation of Georgia. They have never been found in the true Ripley of Alabama, Mississippi or Tennessee, and as I have shown elsewhere the Ripley Cusseta sand of Georgia is of the same age as the Eutaw Coffee sand of Tennessee.

There is a considerable number of forms common to the Patoot beds of Greenland. Thus eight of the Patoot species are found in

the Ripley and the general facies is more similar than this figure would indicate. There are also eight species common to the Vermejo flora of Colorado and New Mexico, all but one dicotyledons, and including several that have been found nowhere else, as the abundant *Cissites panduratus* Knowlton. This would serve to confirm Knowlton's contention that the Vermejo is older than Laramie, since the only Ripley species recorded from the Laramie is *Myrica Torreyi*, which also occurs in post-Laramie deposits in the West. Five Ripley species are found in beds in the West that are referred to the Montana Group, four in the Mesa Verde formation, two in the Fox Hills and five in the Fruitland formation.

As regards comparisons with European Upper Cretaceous floras five species are recorded from beds on that continent classed as Cenomanian, two from beds classed as Turonian, three from beds classed as Emscherian and six from beds which are either Santonian or Campanian in age. The Ripley flora contains noticeable elements common to that of the sands of Aix-la-Chapelle (Aachen). How many it is not possible to determine since large collections from around Aix-la-Chapelle made by Debey were never studied and only the ferns have received adequate treatment. The plants described from the plastic clays of Baume (St. Vaast) by Coemans and found at La Louvière are probably of the same age.

There has been considerable discussion and differences of opinion regarding the age of sands of Aix-la-Chapelle. These sands contain a sparse shallow water marine fauna with *Exogyra*, *Trigonia*, *Eriphyla*, *Inoceramus*, etc., and lenses of clay containing fossil plants. The sands are overlain by a highly fossiliferous glauconitic sand—the *Actinocamax quadratus* zone of the Campanian. This relationship would seem to indicate that the underlying plant bearing beds represented the littoral and continental deposits of the Santonian or at most could not be older than the lower Emscherian Coniacian substage. Despite this Haug refers these sands to the Turonian.

They are siliceous and cross-bedded and in part represent coastal dune sands so that they might conceivably be considerably older than the overlying strictly marine sediments. The question

is important because I regard the Ripley as about the same age, but it cannot perhaps be settled in the present state of our knowledge. I am disposed, however, to regard them as representing the Santonian substage or upper Emscherian.

The present Ripley flora shows no forms that are common to the abundant Wilcox or lower Eocene flora of the Mississippi embayment region—the only forms doubtfully recorded from Eocene in other regions being *Geonomites Schimperi* and the wholly worthless *Halymenites major*. Despite this lack of identical species, which might be expected, the Ripley flora does contain a number of types which become differentiated subsequently and are characteristic elements of the lower Eocene flora in southeastern North America. These are all angiosperms—the pteridophytes and coniferophytes all having become extinct both as to genera and species, or restricted to other regions in the case of some of the coniferophyte genera, before the dawn of the Eocene. Eocene praenuncial characters are seen in the Ripley *Geonomites*, *Drophyllum*, *Celtis*, *Artocarpus*, *Capparis*, *Dalbergia*, *Gleditsiophyllum*, *Cedrela*, *Dillenites*, *Ternstroemites*, *Lauraceae*, *Myrcia*, *Chrysophyllum*, *Bumelia*, and *Apocynophyllum*. Many of these are, of course, coastal types that might be expected to persist in a but slightly changed environment but the same is true as regards habitat of the majority of earlier Upper Cretaceous floras of the Atlantic Coastal Plain so that these differences in the Ripley flora as compared with antecedent floras may truly be regarded as of chronologic value.

Detailed comparisons with the extensive Wilcox flora shows many striking differences. In the latter the old Mesozoic coniferophyte elements are all gone and there are in the Ripley numerous genera of angiosperms commonly considered as temperate forest types such as *Salix*, *Fagus*, *Celtis*, *Liriodendron*, *Platanus*, *Acer*, *Cornophyllum* and *Andromeda*, which are apparently lacking along the Eocene coast of the Mississippi Gulf, although present in the Rocky Mountain and Great Plains region at that time. This would seem to indicate some climatic distinction between Ripley and Wilcox conditions and I am disposed to so consider it, in which event the Ripley would be more distinctly temperate than the Wilcox.

That students in general have underestimated the contrast between Upper Cretaceous and Eocene floras is, I think, obvious. It is the fashion to picture the incoming of the angiosperms in Upper Cretaceous times as a sudden and overwhelming event which in Cenomanian times transformed the Mesozoic floras of ferns, cycadophytes and conifers into an essentially Cenozoic flora of broad-leafed modern forests. At the beginning of Lower Cretaceous time the floras, as might be predicated *a priori*, were essentially Jurassic in type. Only gradually do they become typically Cretaceous and those elements that give them a Cretaceous facies linger in gradually diminishing numbers to the close of the Upper Cretaceous. Floras as early as the Albian show a variety of dicotyledons and many still existing genera are recognized but the numerical representation of dicotyledons in the rocks tends to be illusory, and a large number of the Cretaceous dicotyledons are more or less synthetic types, if one is justified in drawing such conclusions from the evidence of foliage alone. The lower Eocene introduces us to floras of a decidedly different facies and ones that distinctly show a great Cenozoic modernization, despite the difficulty of reflecting this in the current nomenclature of paleobotany. Moreover when it comes to details the change is profound. If the Ripley flora be compared with the Wilcox flora of the same general region the two are seen to be almost totally unlike though living under apparently similar environmental conditions. Both are lowland coastal floras, both are warm temperate in type and yet they have no common species. A tyro would immediately recognize the one as Cretaceous and the other as Tertiary. The Cretaceous cycadophytes and conifers have disappeared in the interval between the two. The flowering plants are distinctly better differentiated and more modern. That these Eocene floras as well as the Upper Cretaceous dicotyledons had ancestors is no more pertinent than the fact that the Eocene mammals had ancestors, in fact the comparison is not inept since the evolution of the flowering plants was, I believe, the major factor that made possible the evolution of the mammals.

It may be noted that of the genera identified in the Ripley flora thirty-five, or 51 per cent, are extinct. Most of these are form-genera of angiosperms and therefore not as precise as

might be wished, although some of these obviously, as in the case of *Ternstroemites*, represent the stock from which the Tertiary and existing genera were differentiated, and it is noteworthy that sixteen of the genera have not been recognized in post Cretaceous deposits. The following are the extinct genera of the Ripley flora: *Halymenites, Raphaelia, Dryopterites, Monheimia, Taeniopteris, Protophyllocladus, Widdringtonites, Cunninghamites, Moriconia, Geinitzia, Alismaphyllum, Doryanthites, Dioscorites, Geonomites, Dryophyllum, Menispermites, Acaciophyllites, Mimosites, Caesalpinites, Gleditsiophyllum, Leguminosites, Euphorbiophyllum, Manihotites, Cissites, Grewiopsis, Dillenites, Ternstroemites, Laurophyllum, Myrtophyllum, Cornophyllum, Acerates, Apocynophyllum, Calcites, Carpolithus, Phyllites.*

There follows a systematic list of the plants that have been identified from the Ripley formation. These will be fully described and illustrated in a Professional Paper of the U. S. Geological Survey, the manuscript of which has already been submitted, but which will probably be several years getting into print.

THALLOPHYTA ?

Halymenites major Lesq.

LEPIDOPHYTA ?

LYCOPODIALES ?

Selaginellaceae ?

Selaginella laciniata Lesq.

PTERIDOPHYTA

FILICALES

Asplenium calopteris (D. & E.) Heer
Raphaelia neuropteroides D. & E.
Raphaelia sp. nov.
Monheimia aquisgranensis D. & E.
Dryopteris Stephensoni Berry
Taeniopteris sp.

CONIFEROPHYTA

CONIFERALES

Protophyllocladus lobatus Berry
Widdringtonites Reichii (Ett.) Heer
Moriconia cycloloxon D. & E.
Moriconia americana Berry
Geinitzia formosa Heer
Araucaria bladenensis Berry
Araucaria Jeffreyi Berry
Cunninghamites elegans (Corda) Endl.
Dammara acicularis Kn.

ANGIOSPERMOPHYTA

NAIADALES

Naiadaceae

Potamogeton sp. nov.
Alismaphyllum sp. nov.

LILIALES

Dioscoreaceae

Dioscorites sp. nov.

ARECALES

Arecaceae

Geonomites Schimperi Lesq. — *Sabalites* sp.

Dicotyledodae

CHORIPETALAE

JUGLANDALES

Juglandaceae

Juglans similis Knowlton — *Juglans* sp. nov.

Myricaceae

Myrica ripleyensis Berry — *Myrica Brittoniana* Berry

Myrica Johnstrupi (Heer) Berry — *Myrica* 7 *spp. nov.*

Myrica Torreyi Lesq.

SALICALES

Salicaceae

Salix Gardneri Knowlton

FAGALES

Fagaceae

Dryophyllum gracile Debey — *Fagus* sp. nov.

Dryophyllum sp. nov.

URTICALES

Ulmaceae

Celtis sp. nov.

Moraceae

Artocarpus sp. nov. — *Ficus Leei* Knowlton

Ficus Krausiana Heer — *Ficus georgiana* Berry

Ficus crassipes (Heer) Heer — *Ficus* 4 spp. nov.

Ficus celtifolius Berry

PLATANALES

Platanaceae

Platanus ripleyensis Berry — *Platanus* sp. (*cf. Credneria*)

RANALES

Magnoliaceae

Liriodendron lardmiense Ward — *Magnolia Capellini* Heer

Menispermaceae

Menispermites variabilis Berry

PAPAVERALES

Capparidaceae

Capparis sp. nov.

ROSALES

Mimosaceae

Acaciophyllites sp. nov. — *Mimosites* sp. nov.

Caesalpinaceae

Caesalpinites 2 spp. nov. — *Bauhinia ripleyensis* Berry

Papilionaceae

Dalbergia 3 spp. nov.

Leguminosae (position uncertain)

Gleditsiophyllum 3 spp. nov. — *Leguminosites* 2 spp. nov.
Leguminosites canavalioides Berry

GERANIALES

Meliaceae

Cedrela sp. nov.

Euphorbiaceae

Euphorbiophyllum antiquum Sap. & Mar. — *Euphorbiophyllum* 3 spp. nov.

SAPINDALES

Celastraceae

Celastrophyllum carolinensis Berry — *Pachystima* (?) *cretacea* Berry
Celastrophyllum 5 spp. nov.

Aceraceae

Acer sp. nov.

RHAMNALES

Rhamnaceae

Rhamnus sp. nov. — *Zizyphus laurifolius* Berry
Rhamnus ripleyensis Berry — *Zizyphus* 2 spp. nov.

Vitaceae

Cissites crispus Velenovsky — *Cissites panduratus* Knowlton

MALVALES

Tiliaceae

Grewiopsis 2 spp. nov.

Sterculiaceae

Sterculia Snowii tennesseensis Berry

PARIETALES

Dilleniaceae

Dillenites sp. nov.

Ternstroemiaceae

Ternstroemites 3 spp. nov.

THYMELEALES

Lauraceae

Cinnamomum Newberryi Berry — *Laurus atanensis* Berry
Cinnamomum 4 spp. nov. — *Laurus coloradensis* Knowlton
Nectandra sp. nov. — *Laurus* 2 spp. nov.
Malapoenna horellensis Berry — *Laurophyllum* sp. nov.

MYRTALES

Myrtaceae

Myrcia havanensis Berry — *Eugenia ? anceps* Berry
Myrcia sp. nov. — *Myrtophyllum angustum* (Velen.) Berry

UMBELLALES

Araliaceae

Aralia wellingtoniana n. var. — *Aralia* sp. nov.

Cornaceae ?

Cornophyllum sp. nov.

GAMOPETALAE

ERICALES ?

Ericaceae ?

Andromeda sp. nov.

EBENALES

Sapotaceae

Chrysophyllum sp. nov. *Bumelia* 2 spp. nov.

GENTIANALES

Asclepiadaceae

Acerates sp. nov.

Apocynaceae

Apocynophyllum 5 spp. nov.

POSITION UNCERTAIN

Calycites sp. nov. *Carpolithus* 3 spp. nov.

Phyllites 3 spp. nov. *Doryanthites cretacea* Berry

THE JOHNS HOPKINS UNIVERSITY,
BALTIMORE, MARYLAND

INDEX TO AMERICAN BOTANICAL LITERATURE

1910–1920

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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